

On Coloration in Mammals and Birds.

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[Read 5th May, 1904.]

ABSTRACT.

THE object of the paper has been to show, firstly, that the colour of a bird or mammal is primarily due to "activity of nutrition and function," which I have called "vigour," and that where conditions for a high state of vigour exist we shall find the majority of animals brightly coloured and *vice versa*.

"Vigour" is dependent on two causes:—

(A) Climate, which contains two factors,

(1) Temperature,

(2) Food;

(B) The Rise and Fall of Sexual Activity.

For *Polar Regions*, where the two causes closely coincide, the changes are much more marked and violent.

In *Temperate Regions*, where the climate is sufficiently severe to affect the "vigour," but where, at the same time, there is a sufficiently long period of comparative plenty to prevent the sexual activity clashing with climate, the changes are less marked.

In *Tropical Regions* the first cause is practically removed, and any changes in colour are due to sexual causes, except in cases of temperate species which have spread into the south.

Now, the individual "vigour" of various species and groups will differ, and one animal may be able to maintain a full vigour under conditions which would be impossible to another. This will account for animals although Polar becoming brightly coloured, *e. g.* Musk Ox, Raven, Penguin, &c. It follows, therefore, that if they can maintain a full "vigour" in colder regions, they can either (i) maintain an equally full vigour in the tropics, or (ii) in hot climates their metabolism would become too active and they would die.

Consequently, a dark-coloured animal in Polar regions must either be confined to those regions or be cosmopolitan, *e. g.* Musk Ox, Raven.

By a similar process of reasoning, bright-coloured tropical animals will be found extending northwards, probably becoming

lighter, while white or light-coloured tropical animals will be confined to the tropics; *e. g.*, Tiger, and *Rhizomys sumatrensis*, the Bamboo Rat.

Seasonal change or migration is a necessity in Polar Regions, and birds, which migrate to the tropics, assume much more gaudy colours while in hot climates, becoming dull when the moult takes place in Arctic Regions, *e. g.* Knot (*Tringa*).

In Temperate Regions seasonal change will be a constant feature, but the changes will not be so marked, *e. g.* Squirrel, Deer; but when these animals reach torrid zones, the "seasonal change" will tend to persist for some time, gradually disappearing, or it may become a "breeding change," as in *Sciurus caniceps*, *Cervus Eldi*.

There is among mammals and birds a process known as "bleaching;" this, I attempt to show, is an *active* process, and not mere action of wind and weather.

I further show that *bleaching* always takes place along certain lines, starting and spreading in various degrees from certain centres; *e. g.*, lips, eyes, ears, crown of the head, occiput, shoulders, thighs, fore end of sternum, vent, tip of tail. To these centres or spots the name "pœcilomere" (spotted part) is given.

The second part of the paper is devoted to showing how these "pœcilomeres" exist as either white or deeply-coloured patches throughout the majority of species of Mammals and Birds: sometimes as large and conspicuous patches, *e. g.* hind-quarters of Rabbit, rump of Bullfinch; and at other times only distinguished from the surrounding parts by difference of shade so slight as to be incapable of serving any warning, protective, or other similar purpose.

It is then pointed out that in some cases the "pœcilomeres" are only visible as transitory patches during the time an animal is undergoing a change of colour.

The head of the Stoat and of a young Shoveller drake are cited, amongst others, as examples of the change taking place along precisely similar lines, whence it is argued that as the outward effect is so slight and transitory, and as the process exists in two animals so widely separated, the fundamental cause must be a deep-seated physiological one.

I therefore claim to have shown that where conditions for

high vigour exist, the majority of the animals will be brightly coloured; and suggestions are made to account for the apparent exceptions to the rule, which suggestions, it is claimed, are borne out by the distribution of the dark polar and light tropical species.

I further claim to have shown that, shortly before the moult in many animals, the colour of the pelage fades, beginning along certain definite areas and from certain centres which I call "*pæcilomeres*," and that this bleaching is due to physiological causes.

Further, that "*pæcilomeres*" may be found throughout the mammalian and avian series, as patches differing either in their intensity or lack of colour from the surrounding portions, in many cases conspicuous and cited as examples of warning, protection, &c.; or, again, as marks so slight as to be unnoticeable unless carefully looked for; or, again, merely appearing as transitory patches during the growth of a new pelage or plumage.

Hence it is argued that these patches so universal, and in many cases so inconspicuous, must owe their inception to internal rather than external causes, and that we have here the basis of diversity of colour, *i. e.* coloration.

If these facts be accepted, both colour and coloration must be due to physiological causes.

The question of whether seasonal changes are produced by moult or by colour change has purposely been entirely omitted as belonging to a side issue.

Natural selection and protective coloration have also been left out, not because I do not believe in the great part they play, but because, if my suggestion be near the truth, they are only able to make use of those colours or modify those markings which in the first place are supplied by vigour.
